L2-(3.2) Characteristics of Quadratic Relations

Key Concepts:
- vertex
- zeroes
  - where are they?
  - how many? 0, 1, or 2
- axis of symmetry
- direction of opening
- optimal value
  - maximum or minimum?

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The vertex is the highest or lowest point on the parabola, and we refer to its coordinates as (h, k).

The axis of symmetry is the vertical line passing through the vertex, having the equation $x = h$.

If the parabola opens up, the coefficient of x^2 is positive ($\Delta^2 y > 0$)
- the vertex is the lowest point
- the minimum (or optimum) value is k

If the parabola opens down, the coefficient of x^2 is negative ($\Delta^2 y < 0$):
- the vertex is the highest point
- the maximum (or optimum) value is k

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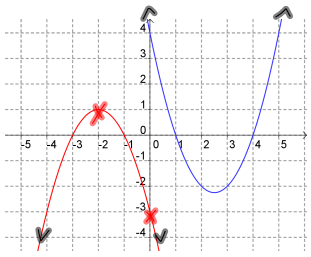
Ex.1. Consider the two graphs:

Can you deduce values for each of the following?



axis of symmetry $= \frac{1+4}{2} = 2.5$

Property	$y = -x^2 - 4x - 3$	$y = x^2 - 5x + 4$
Direction of Opening	Down	up
Maximum or Minimum	max	min
Number of Zeroes	2	2
Axis of Symmetry	$x = -2$	$x = 2.5$
Location of Vertex	$(-2, 1)$	$(2.5, -2.25)$
Location of Zeroes	$(-3, 0)$ & $(-1, 0)$	$(1, 0)$ & $(4, 0)$
y-intercept	-3	4

$y = x^2 - 5x + 4$

$y = (2.5)^2 - 5(2.5) + 4$

$= -2.25$

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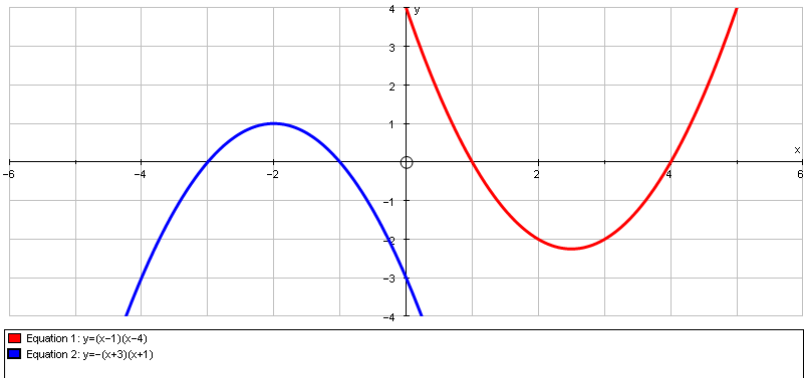
If the parabola crosses the x-axis, the x-coordinates of the crossing points are called the zeroes, or roots, or x-intercepts.

A parabola may have two zeros:



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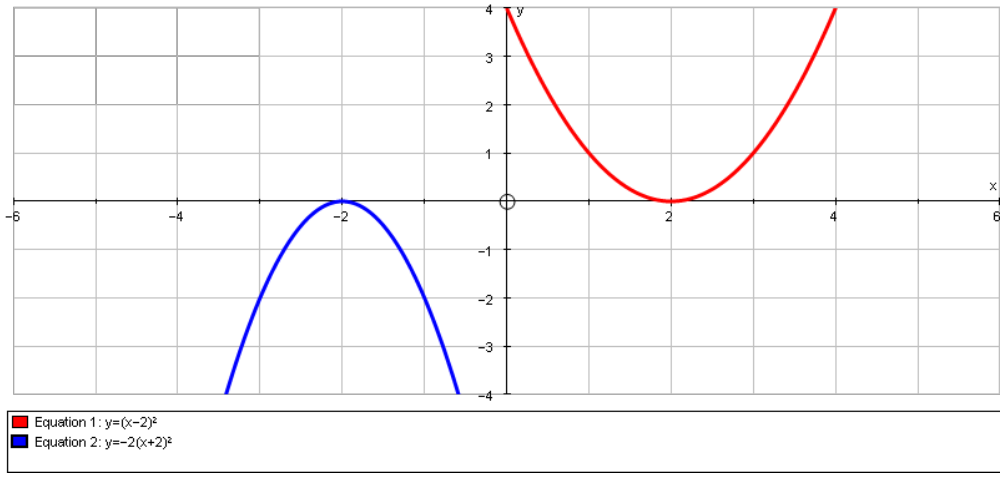
Or one zero:



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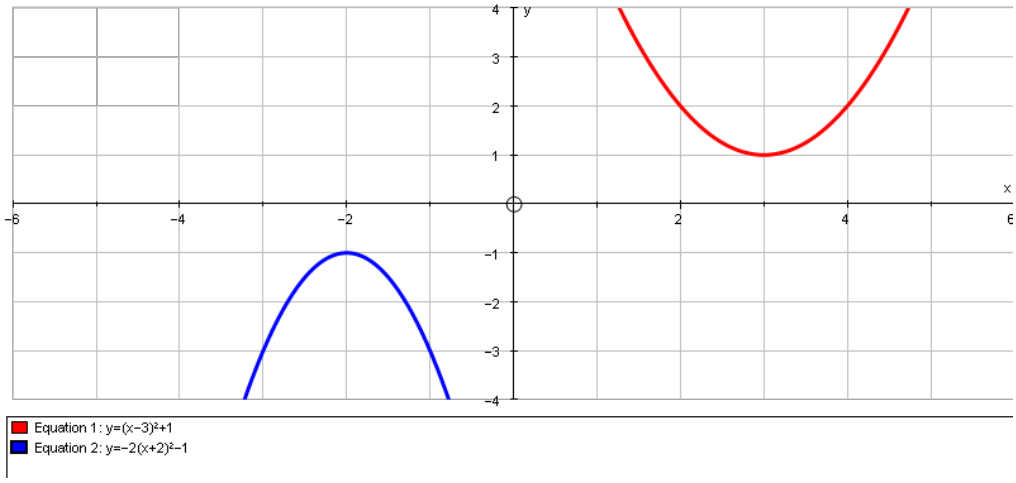
Or no zeroes:



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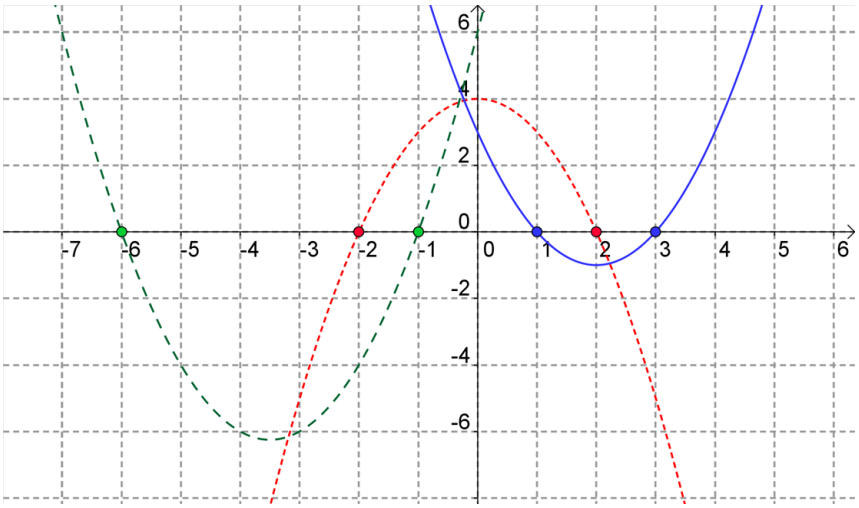
Ex.2. From your graphs, determine key features of each.

$y = x^2 - 4x + 3$ $y = -x^2 + 4$ $y = x^2 + 7x + 6$



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Optimal Value

4 -8 +3

Axis of symmetry

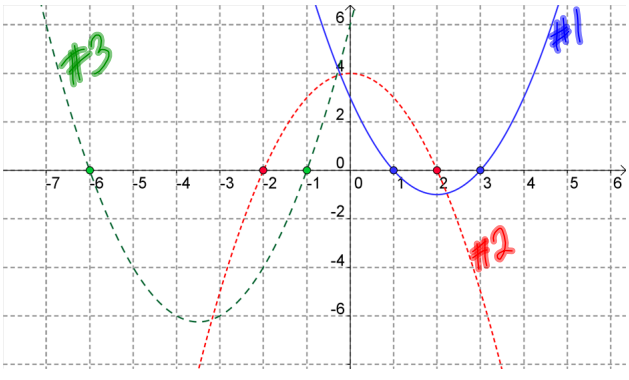
	$y = x^2 - 4x + 3$	$y = -x^2 + 4$	$y = x^2 + 7x + 6$
vertex	(2, -1)	(0, 4)	(-3.5, -6.25)
opening	up	down	up
max/min?	min.	max.	min
max/min value	-1	4	-6.25
y-intercept	(0, 3)	(0, 4)	(0, 6)
zeroes	2	2	2
axis of symmetry	x = 2	x = 0	x = -3.5

zeroes

$x = \frac{-6-1}{2}$

$x = -\frac{7}{2}$

$y = -3$



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Assigned Work:

p. 145 # 1-6, 7ef, 9ab